DEVELOPMENT OF SEMI-AUTOMATIC SOLAR GATE SYSTEM FOR ELECTROMECHANICAL PART

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SUPERVISOR'S DECLARATION

I hereby declare that I have read this project report and in my opinion this project report is sufficient in terms of scope and quality for the award of the Diploma in Mechanical Engineering.

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

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DEDICATION

Firstly, I would like to show my expression Allah s.w.t whose guidance, help and grace was instrumental in making this work become a reality. I would also like to thank my respected lecturer, Mr. Shahmi bin Junoh@Yacob and all lecturers who had guided and helped me a lot to complete this task.

This dedication also goes to my beloved family which is my father Mr. Muda bin Bakar, and my mother, Mrs. Jaharah binti Abdullah and family, without them my pursuit of higher education would not have been possible. Also thanks a lot to the university administration and friends in their support and advice towards this project. Lastly, thanks to all those had helped me to complete my task.

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ABSTRACT

Development of semi-automatic solar gate system for electro-mechanical part is important to open and close the sliding gate. It is uses just a simple system and easy to overhaul this system. It is also safe for the children and to adult too. This system is divided into two groups such as mechanical part and electrical part. For mechanical part, it is designed to be a guard for electrical part. It is also designed to place a solar panel to convert sun light to be an electric current to recharge batteries. With this system, it can save the cost and safe to use. In general, this project is divided into two parts which are mechanical and electrical part.

ABSTRAK

Penghasilan pintu pagar separa automatik menggunakan bekalan kuasa daripada cahaya matahari yang berkawalan daripada sistem elektronik ini digunakan sebagai alat untuk mengawal pintu pagar untuk buka dan tutup. Sistem ini sangat ringkas dan mudah untuk digunakan oleh pengguna. Alat ini adalah selamat digunakan oleh semua pengguna. Sistem ini merangkumi bahagian mekanikal dan elektrikal. Untuk bahagian mekanikal, ia dicipta untuk menjadi pelindung kepada bahagian elektronik daripada terkena air. Ia juga dijadikan tempat untuk meletak ’solar panel’ diatasnya supaya dapat menerima cahaya matahari dan seterusnya dapat membekalkan kuasa kepada bateri. Dengan kaedah ini, ia dapat menjimatkan tenaga yang digunakan bateri untuk membuka dan menutup pintu pagar tersebut. Secara keseluruhannya, projek ini terbahagi kepada dua bahagian yang penting iaitu proses menyediakan bahagian mekanikal dan bahagian elektrikal.

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CHAPTER 1

INTRODUCTION

1.1 PROJECT SYNOPSIS

1.1.1 General project synopsis

Final year project is one of the subjects that are taken to all of final year student. This subject must take in this semester. In this project, it involves the student about designing and fabricating a electro-mechanical controller part for semi-automatic solar gate system. This controller part may different with other controller part in the market. As a diploma final year project allocates the duration of 1 semester, this large man-hour project therefore requires significant efforts of the students to participate. Basically the entire semi-automatic solar gate system for controller part could divide in two general groups, which are mechanical part and electrical part.

Mechanical part for semi-automatic solar gate system is equipped by using all necessary items and method such as L-shape metal, hollow rectangle metal, and skills in manufacturing process by perfume arc welding to weld the part of project. The advantage of this project is save the cost of electric power to generate the system to open and close the gate.

Electrical part for semi-automatic solar gate system is making a circuit of controller part. The equipment for making the circuit is resistor, motor, circuit board, solar panel and etc. This circuit is important in controller part. Without this circuit, the controller part is failed to activate this system.

The process of development is initiated from designing the mechanical and electrical part in this system. It would be considering the function as well. In order to produce user friendly product that is suitable to the customer, consideration to the ergonomic factor. It involve the measurement process before the material are cut into pieces before assembly together by using arc welding for mechanical and soldering for electrical part.[4]

1.1.2 Specific project synopsis

Development to make a electro-mechanical controller part is the main term in this project. This project title is development of semi-automatic gate system for controller part. This project involves small analysis for controller part. The new design is required to improve its durable of mechanical part. Test need to be done to verify the circuit of the controller. It is the most important and need to improve when this project launched.

1.2 Problem statement

This semi-automatic gate system for controller part will primarily can help student and university to save cost. Solar gate is one of the alternative sources to solve the problem. Now, when install the solar panel gate system it can save cost to pay a bill in a month. Today the semi-automatic gate is operated just using the battery power. From this project, the battery is recharge by the solar panel in a daylight hours. So that it can save the cost.

1.3 Project scope

a) Literature review: valuable data are searched and gathered. Considering the shape of the solar panel and method to produce.
b) Sketching & designing: sketching the idea to make a motor controller post and solar panel frame. Also sketching the circuit to control the rotation of motor. Design it with Solid Work software and DXP Propel software.
c) Fabrication: fabricate and produce controller for solar gate system by using all the necessary manufacturing.
d) Testing & evaluate: simulate the semi-automatic solar gate system with the expected functions to be.

1.4 Project Objective

1.4.1 General objective

Diploma final year project objective is to practice the knowledge and skill of the students that have been gathered before in solving problem using academic research, to born and engineer that have a lot knowledge and skill.

This project also important to train and increase the student capability to get know, research, data gathering, analysis making and then solve a problem by research scientific research. The project also will educate the student in communication like in a presentation and educate them to defend their research in the presentation.

The project also will generate students that have a capability to make a good research report in thesis form or in technical writing. This project also can produce and train student to capable of doing work with minimal supervisory and more independent in searching, detailing, and expanding the knowledge and experiences.

Nevertheless, this project important to generate and increase interest in research in work field.

Our project should be finish until the block diagram was get. This project is apply the lesson and knowledgeable that we learn before. Then, we can practice the skill and solving the problem using academic study. This is a project also to create and train a student skill and have an ability to do work personally. It also gives us and experience and lesson. How can we solve the problem with several of way and also write with a good thesis research.[4]

1.4.2 Specific project objective

a) The objectives of this project are to design the electro-mechanical controller strategy of semi-automatic solar gate system.
b) It also teaches how to develop the electrical part of this semi-automatic solar gate system.
c) To develop a mechanical concept/ an electronic concept

1.5 Project planning

ACTIVITIES							W	E	E	K				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Briefing														
Literature Review														
Idea Development														
Concept Design														
Design Analysis														
Mid presentation														
Fabrication														
Report writing														
Final Presentation														

Table 1.1: Gantt chart

According to the table, the project starts with briefing from supervisor. He gives all tasks to do about the project.

The process continued with literature review actual starting from week 2 until week 5. The literature review is all about gathering information about solar gate system.

The process continued with concept design and design analysis. In this task, the motor controller post and solar panel frame is sketched into two types of designs. This task takes time about week 5 to week 8. From the two designs, the combinations of design make a new part and a new design is produced. The new design is draw by solid work software.

The project continued with design of electrical part to control a motor rotation. The fabrication needs preparation of the material. It takes about week 8 to week 14 to finish all and it can function. The combination of electrical part and mechanical part will make a controller part to gate system.

The project continued with thesis writing starting on week 5. It makes a long time to write a good thesis about semi-automatic solar gate system. The thesis writing takes about 10 weeks starting to complete. All the task is scheduled about fourteen weeks overall.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The development of semi automatic solar gate system for electro-mechanical part is important to open and close a sliding gate. Nowadays, the technology to develop a controller to control open and close a sliding gate is spreading. Now, the technology uses the energy source from outside. The energy sources are renewable energy like a hydroelectric energy, solar energy or biomass. It also designed as a part of interior design and makes our periodicals neat and tidy. Uncertainty about the future of fusion research has increased the importance of "renewable" energy sources. Among the most important of these sources are hydroelectric, solar, and wind. In light of diminishing fossil fuels, however, renewable energy may end up as the energy of choice for the 21st century.[2]

2.2 Technical review

2.2.1 Solar energy

Figure 2.1: Solar resource

The name "solar power" is actually a little misleading. In fact, most of the energy known to man is derived in some way from the sun. In fact, there would be no life on earth without the sun, which provides energy needed for the growth of plants, and indirectly, the existence of all animal life. The solar energy scientists are interested in is energy obtained through the use of solar panels.[2]

Advantages

a) Inexhaustible fuel source
b) No pollution
c) Often an excellent supplement to other renewable sources
d) Versatile is used for powering items as diverse as solar cars and satellites

Disadvantages

a) Very diffuse source means low energy production large numbers of solar panels are required to produce useful amounts of heat or electricity
b) Only areas of the world with lots of sunlight are suitable for solar power generation

2.2.2 Hydroelectric energy

Figure 2.2: Hydroelectric resource

Man has utilized the power of water for years. Much of the growth of early colonial American industry can be attributed to hydro power. Because fuel such as coal and wood were not readily available to inland cities, American settlers were forced to turn to other alternatives. Falling water was ideal for powering sawmills and grist mills. As coal became a better-developed source of fuel, however, the importance of hydro power decreased.[2]

Advantages

a) Inexhaustible fuel source
b) Minimal environmental impact
c) Viable source--relatively useful levels of energy production

Disadvantages

a) Smaller models depend on availability of fast flowing streams or rivers
b) Run-of-the-River plants can impact the mobility of fish and other river life.

2.2.3 Biomass energy

Figure 2.3: Biomass resource

Although chances are that you have never heard of "biomass" before, it is one of the oldest and most well-established energy sources in the world. Biomass is simply the conversion of stored energy in plants into energy that we can use. Thus, burning wood is a method of producing biomass energy. If the burning of wood were the only biomass application, then that field of study would not be nearly as interesting as it is. In fact, biomass has many possibilities as a renewable energy source. High energy crops grown specifically to be used as fuel are being developed, and scientists are beginning to consider agricultural and animal waste products as possible fuel sources.[2]

Advantages

a) Theoretically inexhaustible fuel source
b) When direct combustion of plant mass is not used to generate energy
c) Alcohols and other fuels produced by biomass are efficient, viable, and relatively clean-burning
d) Available throughout the world

Disadvantages

a) Could contribute a great deal to global warming and particulate pollution if directly burned
b) Still an expensive source, both in terms of producing the biomass and converting it to alcohols
c) On a small scale there is most likely a net loss of energy--energy must be put in to grow the plant mass

2.3 Gas Metal Arc Welding (GMAW)

2.31 Basic theory of Metal Inert Gas (MIG) Welding

Gas metal arc welding (GMAW), also known as metal inert gas or MIG welding, is a semi-automatic or automatic process that uses a continuous wire feed as an electrode and an inert or semi-inert gas mixture to protect the weld from contamination. As with SMAW, reasonable operator proficiency can be achieved with modest training. Since the electrode is continuous, welding speeds are greater for GMAW than for SMAW. The mechanical part will be joined using this MIG welding process. **Figure 2.4** show the basic structure of the MIG welding.[3]

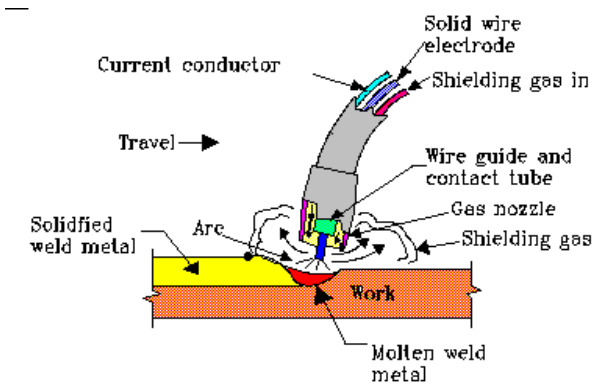

Figure 2.4: Basic structure of MIG welding

2.4 Floor cutter disc machine

A floor cutter disc machine uses a composite disc. Floor cutter disc machine can be used for woodworking, metal working, or for cutting a variety of other materials, and are particularly useful for cutting irregular shapes. The radius of a curve that can be cut on a particular saw is determined by the width of the band and its lateral flexibility. In this project, it is used to cut the raw material to the specific size that is needed.

2.5 Bolt and Nuts

After drilling and welding process, bolt and nuts are used to join the solar panel frame to motor controller post

2.6 Grinding / Finishing

The finishing process uses the grinding machine to make the solar panel frame and motor controller post surface smooth and neat.

2.7 Painting

The last process is painting process. Product will look more attractive and it also will prevent the product from corrosion.

2.8 Soldering

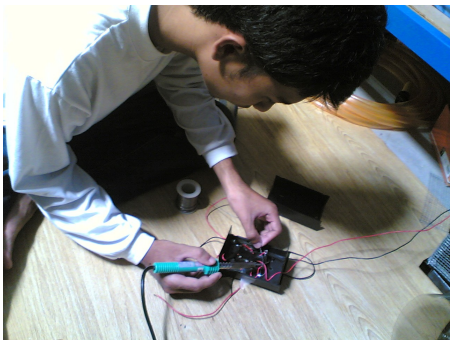

Figure 2.5: Soldering

Soldering is a process in which two or more metal items are joined together by melting and flowing a filler metal into the joint, the filler metal having a relatively low melting point. The filler metal used in the process is called solder. Soldering is distinguished from brazing by use of a lower melting-temperature filler metal; it is distinguished from welding by the base metals not being melted during the joining process. In a soldering process, heat is applied to the parts to be joined, causing the solder to melt and be drawn into the joint by capillary action and to bond to the materials to be joined by wetting action. After the metal cools, the resulting joints are not as strong as the base metal, but have adequate strength, electrical conductivity, and water-tightness for many uses.

2.8.1 Soldering Tools

2.8.1.1 Soldering Irons

There are several things to consider when choosing a soldering iron.

- adjustable or fixed temperature
- power source (electric or gas)
- portable or bench use

CHAPTER 3

METHODOLOGY

3.1 Project Flow Chart

From the flow chart, this project is started with introduction. In the introduction has a project background, objective and problem statement. The project background is important because to make what product we must do. The objective is to make a different point to finish a product. And also, the problem statement is to find what a problem why must design product.

Then the literature review study. In the literature review study, the researches to the existing product in the current market. The purpose of this research is to compare the advantages, disadvantages and design of the product in the current market base on the main objective of the project such as development of semi-automatic solar gate system for controller part.

After the literature review and find the product in current market. The sketching is manually on A4 paper. Mechanical and electrical concept designs into A4 paper for select a good design and circuit of product. In this sketch method, the design on the concept will be perform to find their abilities and good concept.

When this concept selection is done, an analysis of design is done on the cost and failures to the new product choose. The purpose of this analysis is to make sure the product followed the main objective of the project. After the final result of the analysis, the detail design will be develop (2D or 3D drawing). Circuit for electrical also develop in DXP software.

After all the drawing finished, the drawing was used as a reference for the next process, which it is fabrication stage. This process is consists fabricate all the parts that have design before by following all the dimension using various type of manufacturing process. The manufacturing process included in this process is welding by using MIG, cutting by using disc cutter, drilling and others. Also use the electrical process like a solder and make a circuit electrical part.

Then, all the process mentioned above is done; all the material for report writing is gathered. The report writing process will be guided by the UMP final year project report writing. This process also, preparation for presentation slides for the final presentation for this project.

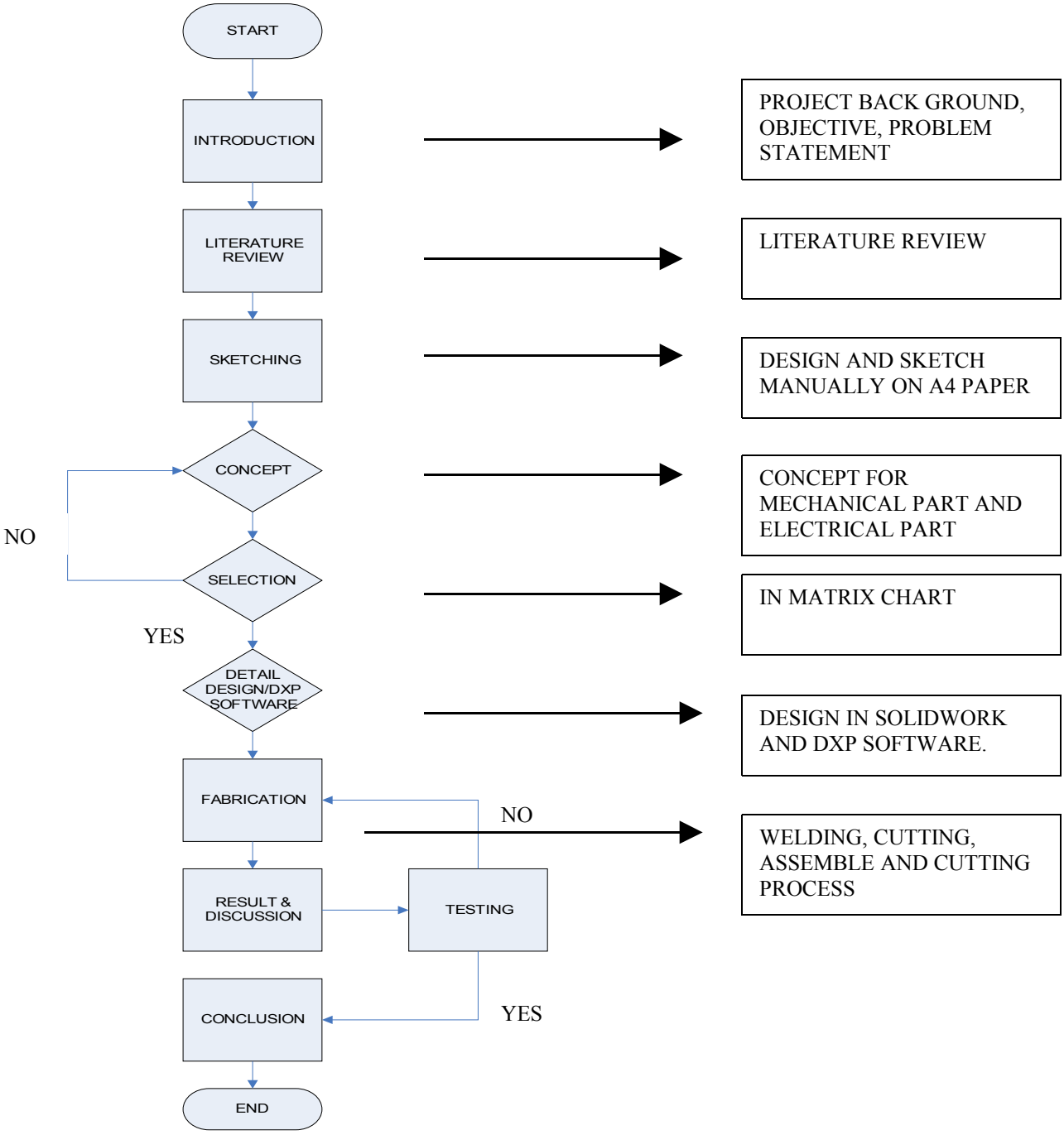

Figure 3.1: Flow chart

3.2 Design an electrical part

Development of semi-automatic solar gate system for controller part is important. It because the electrical system most important to move a gate. The circuit for controller part must be sketching and designing carefully. The design consideration must be done carefully so the design can be fabricated and functioning. The aspects that must be considered in controller part are:

a) Strength: it is important criteria in design the controller part because this system (motor) uses about 12-24 volts. Also need 1.50-2.00 ampere of current.
b) Material: availability of material is one of the aspects that have been considered. The material available can be use depend on their purpose.
c) Cost: cost to make a controller part must be reasonable.

3.2.1 The categories for electrical part are:

a) Sketching: Sketching the electrical circuit in paper and modify it.

b) DXP software practice: After sketch the circuit and the circuit can run. The circuit will be design in DXP software.

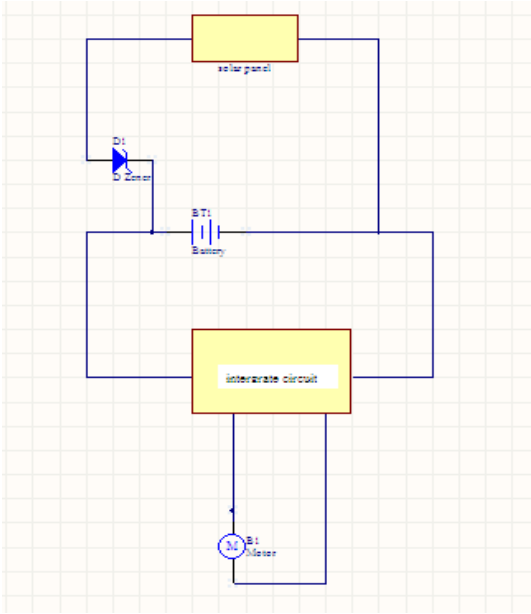

Figure 3.2: Diagram of whole electrical part

This diagram show the solar panel is the charger to the batteries. It always recharges the batteries in daylight only. The electric current will flow to the integrate circuit. In integrate circuit, the push button switch are the important thing to control the rotation of motor.

3.2.2 Sketching of integrates circuit

From the ideal that given from supervisor, the motor need to rotate in clockwise and counter clockwise when it control from push button switch.

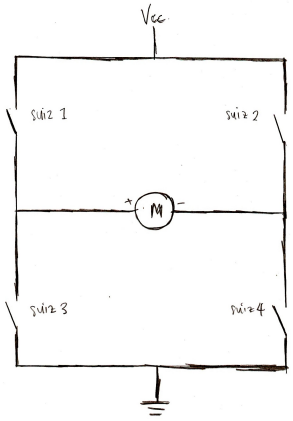

Figure 3.3: Concept A

3.2.2.1 Concept A

The design of electrical circuit in **figure 3.3** needs four push button switches. The circuit only can flow in 24 volts to below. The motor can rotate but not to smooth because of the voltage flow. Cost to make this circuit is expensive and difficult to user to push two buttons simultaneously to open and close the gate.

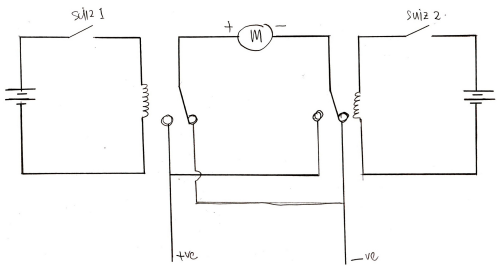

Figure 3.4: Concept B

3.2.2.2 Concept B

The design of electrical circuit in **figure 3.4** need only two push button switch. One of the push button is to open the gate and other one to close the gate. This circuit can flow about 12 volts and above and can flow the high ampere of current to rotate the motor. It is because used two relay to rotate the motor clockwise and other one. Just need to push one push button in one time to open and close.

3.2.3 Concept generation and evaluation

Two concepts for the electrical circuit are developed. These are evaluated again the datum of the standard electrical circuit.

a) Concept A: need four push buttons cannot ease to use, not easy to handling and need just small amount current can flow.
b) Concept B: need two push button, ease to use and ease to handling. Can flow high amount of current flow to rotate the gear of motor.

3.2.4 Finalize design of electrical circuit

After the selected design electrical circuit was chosen, now the selected design or concept sketched is transfer to DXP propel software to generate the circuit functioning. Below show the actual design of the electrical circuit to controller part.

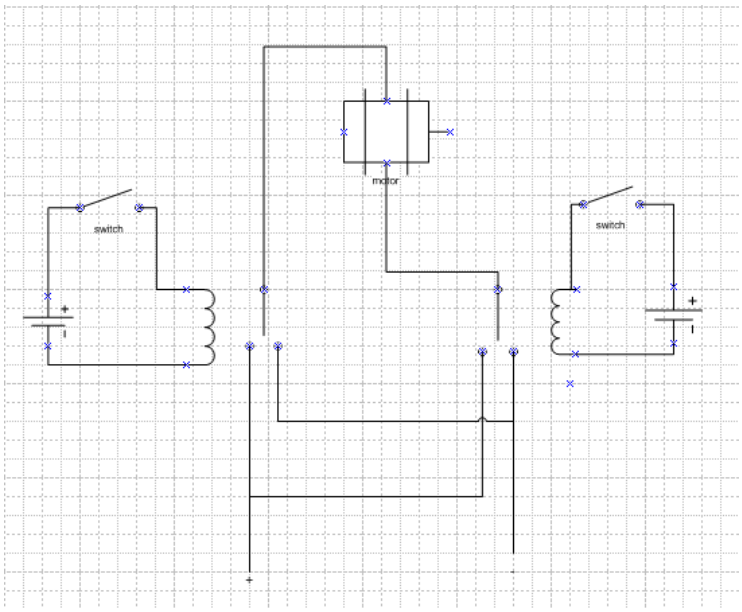

Figure 3.5: Electrical circuit

3.3 Material preparation

Material preparation as shown in figure is start after the design electrical circuit done. The materials that use to generate the electrical circuit are:

Figure 3.6: Relay

Figure 3.7: Diode zener

Figure 3.8: Push button switch

3.4 Fabrication process

The fabrication process is start with get the voltage of solar panel in daylight hours. It is important because the function of solar is to recharge the batteries in daylight hours.

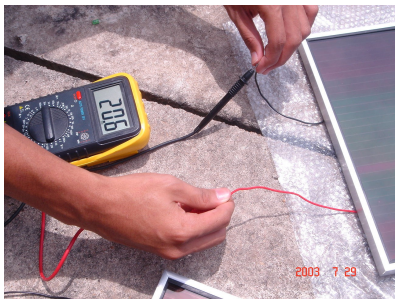

Figure 3.9: Check the voltage

The process is continued with soldering process of electrical part. This process use soldering iron and the solder to joint the relay with the wire using solder.

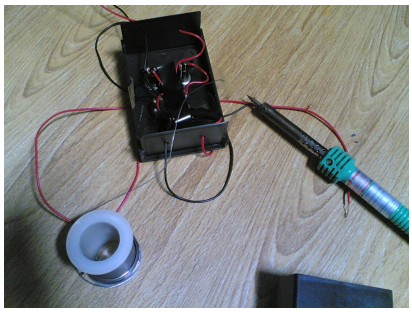

Figure 3.10: Soldering